STANDARD FOR PERMANENT RECORD PHOTOGRAPHIC MICROCOPYING FILM

(Gelatin-Silver Halide Emulsion Type)

The exposed and processed film shall be of such a type that the quality of the image shall remain permanent under ordinary storage conditions. All film shall be of approved type of 16 mm or 35 mm size either perforated or unperforated as specified by the purchaser. Several manufacturers are making microcopying film to comply with this standard. Whenever practicable it is recommended that the approved types of film be used since it not only greatly reduces the number of expensive tests but also assures the user, with reasonable certainty, that film suitable for permanent records is being used. Permanent record type of microcopying film which has received the approval of the National Bureau of Standards may be identified by a solid triangle after the word "safety" in the edge marking of the film.

DETAILED REQUIREMENTS

Emulsion:

The emulsion or light sensitive coating shall be composed of silver-halide crystals of a size distribution entirely suitable for microcopying use, uniformly dispersed in a thin layer of high grade gelatin on one side of the film base. The white-light and spectral sensitivities shall be such that accurate and complete copies of the documents are obtained with the usual exposure and development technique.

Processing:

The film shall be developed with the usual organic developing agents such as "Metol", hydroquinone, glycin, etc., compounded to produce a silver image essentially black. Developers producing stained or colored images are not to be used. The films shall be fixed in the usual sodium thiosulphate fixing bath. Fixing baths containing ammonium thiosulphate shall not be used. No intensification or reduction of the developed image is permitted.

Hypo Content of Emulsion:

The hypo (sodium thiosulphate) content of the processed film shall not exceed 0.005 mg per square inch of film. The hypo content shall be determined by the method of Crabtree and Ross in the Journal of the Society of Motion Picture Engineers, Vol. 14, p. 419 (1930)*. One square inch of film

*In this article (p. 426) the sensitivity of the mercuric chloride test is given as 0.05 mg of hypo without stating the volume of solution or area or length of film. This value

is obviously for 1 foot of film since with ordinary care 0.005 mg per frame of 35 mm film (1 square inch) is detectable.

(1-5/8" of 16 mm film or 3/4" of 35 mm film) is immersed in a shell vial 3/4 x 4" containing 10 ml of the following solutions:

Potassium bromide	25 grams
Mercuric chloride	25 grams
Water to make	1 liter

After the sample has remained in the above solution for 15 minutes the turbidity is compared with that of three similar shell vials containing the above solution, one with no hypo, one with 0.005 mg, and one with 0.010 mg hypo ($Na_2S_2O_3$). The comparison is made in a darkened room using a mercury lamp for illumination. The shell vials should rest on a black surface, the light entering from one side of the vials. The criterion is that the turbidity of the tested solution should not exceed that of the one having 0.005 mg of hypo.

Flexibility:

Flexibility is determined by means of a Pfund folding endurance tester used as described by Weber and Hill, National Bureau of Standards Miscellaneous Publication M158, obtainable from the Superintendent of Documents, Government Printing Office, Washington, D.C., price 5 cents.

Processed film, conditioned at 65% relative humidity, shall stand at least 16 single folds in the Pfund tester (19 mm between jaws) without breaking. Film aged 72 hours at 100°C and conditioned at 65% relative humidity shall not lose more than 25% in folding endurance of the original sample.

Film Base:

The film base shall be the slow burning cellulose-acetate type known as "safety" film. The thickness of the film base and emulsion shall be 0.0055± 0.0010 inch.

Relative Viscosity:

Four strips of processed film weighing 1.000 g. each are cut from the sample. Two of the strips are aged at 100°C for 72 hours. Each of the strips is dissolved in approximately 95 ml of reagent grade acetone in 100 ml volumetric flasks. Solution may be effected by repeated shakings for one to two hours or allowing it to stand over-night. After solution of the film base is completed and the emulsion has settled to the bottom, the flasks are immersed in a waterbath maintained at 30±0.05°C. When temperature equilibrium has been reached and the volume of the solution adjusted to 100 ml, a 5 ml portion is transferred to an Ostwald pipette immersed in the same constant-temperature bath. The time of flow of the solution through the capillary of the pipette is measured to

at least one-fifth second. The time of flow is also measured for a 5 ml portion of the pure solvent. Not less than three readings should be made for each 5 ml portion The relative viscosity is then calculated as the ratio of the time of flow of the solution to the time of flow of the solvent. Duplicate determinations shall be made on both the original and aged film sample and the duplicates should agree within five-tenths of a second. The change in relative viscosity caused by aging shall not exceed 5%.

pH Stability:

Four strips of processed film weighing 1.00 g. each are cut from the sample. Two of the strips are aged at 100°C for 72 hours. Each strip is placed in a 200 ml Erlenmeyer flask and dissolved in 100 ml of acetone-water solution containing 10 percent by volume of water. Solution may be effected by repeated shakings for one to two hours or allowing it to stand over-night. After solution of the film base is complete the pH of the solutions is measured with a glass electrode. The change in pH between the original and aged samples shall not exceed 0.5 pH unit. Duplicate determinations shall be made on both the original and aged film sample and the duplicate shall agree within 0.1 pH unit. Both the water and acetone shall be purified by distillation.

Nitrogen Content:

The film base shall not contain more than 0.15% nitrogen as cellulose nitrate. The determination for nitrogen shall be made as follows:

2.00 grams of film base, emulsion removed, are placed in an 800 ml Kjeldahl flask. Ninety ml of 30% sodium hydroxide and 10 ml of ethyl alcohol are added. The sample is heated on the steam bath or over a low flame and 25 ml of 30% hydrogen peroxide are added slowly with agitation using a stirring rod or shaking the flask. When the first portion of hydrogen peroxide is boiled out, another 25 ml portion of hydrogen peroxide is added which is usually sufficient to dissolve completely the film base. The contents of the flask will now be about 200 ml. (See note 1)

1. When evaporating the solution following the peroxide digestion, mechanical loss by entrainment may occur if the solution is boiled down too far. This will give low results.

The solution is evaporated over a flame to about 75 ml volume to remove the last traces of ammonia, diluted to a total of 350 ml with distilled water, cooled, and immediately before connecting the flask to the Kjeldahl apparatus, 2.5 grams of DeVarda's alloy are added quickly. (See note 2)

2. The total volume of the sample at the time of the addition of the DeVarda's alloy must be closely controlled. Too

much or too little water added changes the alkali concentration so that the rate of reaction with the alloy and the corresponding reduction of the sodium nitrate present will be erratic.

About 200 ml of distillate are collected in a 500 ml Erlenmeyer flask containing 50 ml of standard tenth-normal sulphuric acid. (See note 3) The excess acid is back titrated with tenth-normal sodium hydroxide using methyl red as indicator.

3. When distilling the sample after addition of the DeVarda's alloy, some alkali may be carried over into the standard acid by entrainment if the distillation is carried too far or is too vigorous. This will give high results.

A blank determination is made on the reagents using the same quantities that are used in the actual determination. (The difference in the number of milliliters of hydroxide required for the blank and the sample, multiplied by 0.07, gives the percentage of nitrogen.)

National Bureau of Standards
September 14, 1943.

Rel #3786	.005
4196	.005
5134	.005
5204	.005
5268	.005
5275	.005
5288	.005

The thyro content is actually less than .005 MG per square inch for all 7 test strips.

The above are for [redacted]

STAT

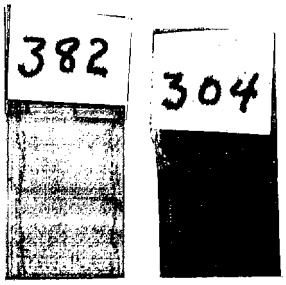
3 NOV 54	Residual Hypo Test
Rec'd #	Results
394	.005 MG hypo/cg. in.
1694	.005 MG hypo/cg. in.
1687	.005 MG hypo/cg. in.
1688	.005 MG hypo/cg. in.
1697	.005 MG hypo/cg. in.
1698	.005 MG hypo/cg. in.
1699-2	.005 MG hypo/cg. in.

Please send at least 2 inch ~~strips~~ for hypo tests in the future as several of these barely met the size requirement for the Crabtree & Ross Test.

Record
5-2

A residual fogged test could not be made on Reels 304-310-382-394 since they are clear film. The test can only be made with either entirely fogged film, partially fogged film or a portion of film including some exposed frames.

Another requirement is that the film be free of fingerprints, dirt or other foreign matter.



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